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X-701B Holding Pond and Retention Basins Corrective Measures Implementation Program Plan for the Portsmouth Gaseous Diffusion Plant Piketon, Ohio

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BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
Paducah Gaseous Diffusion Plant   Portsmouth Gaseous Diffusion Plant
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Pro2Serve® Technical Solutions

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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ACRONYMS

ACO	Administrative Consent Order
ARARs	applicable or relevant and appropriate requirements
BJC	Bechtel Jacobs Company LLC
CAS	Cleanup Alternatives Study
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	contaminant of concern
DFF&O's	Director's Final Findings and Orders
DNAPL	dense non-aqueous phase liquid
DOE	U.S. Department of Energy
FONSI	Finding of No Significant Impact
IGWMP	Integrated Groundwater Monitoring Plan
IRM	Interim Remedial Measure
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
Ohio EPA	Ohio Environmental Protection Agency
PCB	polychlorinated biphenyl
PITT	partitioning interwell tracer test
PORTS	Portsmouth Gaseous Diffusion Plant
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SWMU	solid waste management unit
TCE	trichloroethene
TEVE	thermally enhanced vapor extraction
U.S. EPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (Ohio EPA) agreed, during a December 12, 1994 Decision Team meeting, that a site-wide program plan would be developed to provide a general framework for controlling and implementing corrective action alternatives at the Portsmouth Gaseous Diffusion Plant (PORTS). The generic *Corrective Measure Implementation Program Plan Portsmouth Gaseous Diffusion Plant* (DOE 1999a) was submitted in April 1997 and approved by Ohio EPA and subsequently revised in May 1999 to reflect changes that occurred. The generic program plan consists of the following distinct sections: Program Management Plan, Program Community Relations Plan, Construction Quality Assurance Program Plan, Safety and Health Accident Prevention Plan, and Generic Schedule. The generic program plan is supplemented by quadrant-specific (or unit-specific) Corrective Measures Implementation (CMI) program plans for corrective actions in each quadrant (or unit). This X-701B CMI Program Plan also includes an updated Program Community Relations Plan as Appendix B.

This X-701B CMI Program Plan includes specific activities outlined in the X-701B Decision Document (Ohio EPA 2003). A brief description of the two units (soils only and groundwater area) follows.

X-701B Holding Pond and Retention Basins (soils only)

The X-701B Holding Pond was an unlined 200 ft by 50 ft pond used for the neutralization and settling of metal-bearing and acidic wastewater. The X-701B Holding Pond was in use from 1954 until November 1988 and was regulated as a National Pollutant Discharge Elimination System (NPDES) outfall between August 1983 and September 1991. Most of the waste discharged to the pond originated at the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building. From 1974 until 1988, slaked lime was added to the X-701B influent at the X-701E Neutralization Facility to neutralize the low pH and induce precipitation. This precipitation caused large amounts of sludge to accumulate in the pond and necessitated periodic dredging of the sludge. The sludge recovered during dredging was stored in two retention basins located northwest of the pond.

The X-701B East and West Retention Basins were unlined sludge retention basins used for the settling, dewatering, and storage of sludge removed from the X-701B Holding Pond. The East Retention Basin, built in 1973, was approximately 220 ft by 65 ft (narrowing to 25 ft wide in the northeast corner) and was 3.5 ft deep. The east basin was in use from 1973 until approximately 1980. The West Retention Basin was built in 1980, when the east basin reached capacity. The west basin was approximately 220 ft by 45 ft (narrowing to 35 ft wide in the northern portion) and was 3 ft deep. The west basin was in use from 1980 until 1988.

In 1989, PORTS initiated a two-phase closure of the unit. As part of the first phase, sludge was excavated from the holding pond and two retention basins. The sludge was dewatered, placed in containers, and transported to on-site storage. The retention basins were backfilled, graded, and seeded. The second phase began in 1994, and included construction of a groundwater pump-and-treat system and in situ treatment of soils in the bottom of the holding pond with thermally enhanced vapor extraction (TEVE). Limestone riprap and gravel were placed on the bottom of the holding pond to support the soil treatment equipment. Use of TEVE was terminated after it failed to achieve identified performance standards. However, the limestone riprap and gravel material currently remains in the holding pond, and a gravel access road remains on the southeast side of the holding pond. Two pumps in a sump located in the low point of the holding pond remain operational. The water removed by these two pumps is transferred, via underground piping, directly into the X-623 Groundwater Treatment Facility.

During 1997 and 1998, an investigation of the X-701B Retention Basin area revealed that the saturated fill material in the retention basins was contaminated with uranium and technetium at concentrations that exceed preliminary remediation goals (PRGs). In addition, detectable concentrations of transuranics were discovered. The higher radionuclide concentrations found in the fill material are believed to be the result of incomplete removal of sludge during initial closure actions at the retention basins. Existing data does not indicate that radioactive contaminants are migrating from the retention basins to either surface water or groundwater at concentrations exceeding PRGs.

X-701B Groundwater Area

This area of groundwater contamination extends east from the vicinity of the former X-701B Holding Pond to the vicinity of Little Beaver Creek. The plume width does not exceed 500 ft. Trichloroethene (TCE) concentrations in the most highly contaminated portions of this plume exceed 100,000 μg/L.

A comprehensive series of groundwater model simulations incorporating various remedial technologies, both alone and in combination, have been evaluated. These model simulations indicate that it is not practicable to move a sufficient quantity of water through the Gallia saturated zone to remediate groundwater and associated saturated soils to concentrations less than PRGs in all areas of the plumes within the targeted 30-year timeframe. Even with extensive application of best available technologies, the hydrogeologic conditions in this area preclude achieving the target risk level of 1×10^{-6} within 30 years. However, these simulations do indicate that groundwater contaminant levels can be reduced to an acceptable risk level of 1×10^{-5} in a much shorter timeframe, thereby attaining the concentrations that are as low as reasonably achievable given the constraints of the local hydrogeologic system.

The Ohio EPA issued the X-701B Decision Document, outlining specific selected corrective measures for X-701B, on December 8, 2003 (Ohio EPA 2003). The major components of the corrective measures for the X-701B solid waste management units (SWMUs) are:

- Select solids excavation and consolidation in conjunction with capping of the X-701B Holding Pond and Retention Basins. This alternative includes selected excavation of soil in identified outlying areas where there have been sporadic detections of contaminants and installation of a multimedia cap system over the X-701B Holding Pond and Retention Basins. Institutional controls include deed and access restrictions.

- Remediation of the X-701B Groundwater Area using oxidant injection, groundwater recirculation, and phytoremediation, if necessary. The X-701B Interim Remedial Measure (IRM) trench would continue to extract contaminated groundwater.

This CMI Program Plan for X-701B summarizes the activities to be performed under the CMI Program, as well as a schedule for accomplishing the construction tasks. Four tasks are required under the CMI Program:

- CMI Program Plan (this document) (Task 12);
- Corrective Measure Design (Task 13);
- Corrective Measure Construction (Task 14); and
- Reporting (Task 15).

This CMI Program Plan for X-701B, along with the generic CMI Program Plan, summarizes the activities to be conducted to ensure compliance with federal, state, and local regulations, and applicable or relevant and appropriate requirements (ARARs) outlined in the X-701B Decision Document.

1. INTRODUCTION

The U.S. Department of Energy (DOE) signed enforcement agreements with the U.S. Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (Ohio EPA). These agreements require DOE to prepare a Corrective Measures Implementation (CMI) Program Plan before the implementation of a Resource Conservation and Recovery Act (RCRA) corrective measure at the Portsmouth Gaseous Diffusion Plant (PORTS) near Piketon, Ohio.

Both U.S. EPA and Ohio EPA agreed during a December 12, 1994 Decision Team meeting that a generic site-wide program plan would be developed to provide a general framework for controlling and implementing corrective action alternatives at PORTS (DOE 1999a). The program plan would then be supplemented by quadrant-specific (or unit-specific) CMI program plans for corrective actions in each quadrant (or unit).

This X-701B CMI Program Plan includes specific activities outlined in the X-701B Decision Document (Ohio EPA 2003). A schedule for accomplishing the construction tasks is included as Appendix A of this plan. This unit-specific plan, along with the generic CMI Program Plan, summarizes the activities to be conducted to ensure compliance with federal, state, and local regulations, and applicable or relevant and appropriate requirements (ARARs) outlined in the Decision Document. The Ohio EPA issued the X-701B Decision Document on December 8, 2003.

2. SITE LOCATION AND DESCRIPTION

The PORTS facility was constructed between 1952 and 1956 and is owned by DOE. The active portion of the PORTS facility occupies approximately 1000 acres of a 3714-acre DOE reservation in south central Ohio, approximately 80 miles south of Columbus, Ohio, 20 miles north of Portsmouth, Ohio, and 1 mile east of U.S. Route 23, near Piketon, Ohio. The site is located in central Pike County. Surrounding counties include Ross, Jackson, and Scioto (Fig.1).

The PORTS facility occupies an upland area of southern Ohio with an average land surface elevation of 670 ft above mean sea level. The terrain surrounding the facility site consists of marginal farmland and wooded hills, generally with less than 100 ft of relief. The facility is located on a mile-wide, preglacial buried river valley.

The PORTS site is drained by Little Beaver Creek, Big Run Creek, the West Drainage Ditch, and an unnamed southwest drainage ditch. Sources of water for the surface water flow system include precipitation runoff, groundwater discharge, and facility effluent. Surface water runoff from the facility site eventually drains into the Scioto River, which flows from north to south and is located approximately 2 miles west of the facility. The Scioto River is approximately 130 ft lower in elevation than the PORTS site.

The principal process at the PORTS facility was the separation of uranium isotopes via gaseous diffusion. The PORTS facility had been in operation since 1955, but ceased enrichment operations in May 2001. Prior to 1992, some of the enriched uranium was generated for utilization by the U.S. Navy. The United States Enrichment Corporation assumed responsibility for the uranium enrichment operations at PORTS on July 1, 1993. Support operations included the feed and withdrawal of material from the primary enrichment process, water treatment for sanitary and cooling purposes, decontamination of

Figure 1

equipment removed for maintenance or replacement, recovery of uranium from various waste products, and treatment of sewage wastes and cooling water blowdown. The construction, operation, and maintenance activities performed at the PORTS facility generated inorganic, organic, and low-level radioactive wastes, which some have been stored or disposed of on site.

3. CLEANUP AGREEMENTS AND REGULATORY COMPLIANCE

In August 1989, DOE and the State of Ohio entered into a Consent Decree that outlined the requirements for handling hazardous waste generated at the PORTS facility and conducting investigations and Cleanup Alternatives Studies (CASs) at the site. U.S. EPA and DOE entered into a similar agreement, the Administrative Consent Order (ACO), in September 1989. The ACO was substantially modified in 1997. The ACO requires that PORTS conduct a RCRA Facility Investigation (RFI) and a Corrective Measures Study (CMS), select remedies, and implement them according to a CMI Program Plan. A schedule is attached to each agreement outlining document submittals to Ohio EPA and U.S. EPA. The ACO and Consent Decree require corrective actions based on RCRA and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

The National Environmental Policy Act (NEPA) of 1969 requires all federal agencies to consider the possible effects (both adverse and beneficial) of all proposed activities or actions, in accordance with 10 CFR 1021 and DOE Order 5451.1. DOE submitted the Environmental Assessment for the Quadrant II Corrective Measures Implementation in January 2003 (DOE 2003a), and the Finding of No Significant Impact (FONSI) was approved on February 24, 2003.

This X-701B CMI Program Plan was prepared using guidance in the ACO. The CMI activities will be performed to implement the approved remedies according to RCRA and CERCLA requirements. Permits will be obtained as necessary.

The X-701B Holding Pond and Retention Basins solid waste management units (SWMUs) are located in Quadrant II and were included in the Quadrant II CAS/CMS Final Report (DOE 2001a), which was submitted by DOE and approved by U.S. EPA and Ohio EPA in 2001. The X-701B Holding Pond and Retention Basins (soils only) and the X-701B Groundwater Area require development of alternatives due to the presence of radionuclide and volatile organic compound (VOC) contaminants. Additional soils and groundwater alternatives were developed in an addendum (DOE 2001b) and an attachment (DOE 2002a) to the Quadrant II CAS/CMS Final Report.

4. DESCRIPTION OF SWMUs AND COMPLETED REMEDIAL ACTIONS

The following sections contain a brief description of the X-701B Holding Pond and Retention Basins (soils only) and the X-701B Groundwater Area and remedial actions which have been completed.

4.1 X-701B HOLDING POND AND RETENTION BASINS (SOILS ONLY)

The X-701B Holding Pond was an unlined, 200 ft by 50 ft pond used for the neutralization and settling of metal-bearing wastewater, solvent-contaminated solutions, and acidic wastewater. The X-701B

Holding Pond was in use from 1954 until November 1988 and was regulated as National Pollutant Discharge Elimination System (NPDES) Outfall 001A between August 1983 and September 1991. Most of the waste discharged to the pond originated at the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building. From 1974 until 1988, slaked lime was added to the X-701B influent at the X-701E Neutralization Facility to neutralize the low pH and induce precipitation. This precipitation caused large amounts of sludge to accumulate in the pond and necessitated periodic dredging of the sludge. The sludge recovered during dredging was stored in two retention basins located northwest of X-701B (Fig. 2).

The X-701B East and West Retention Basins were unlined sludge retention basins used for the settling, dewatering, and storage of sludge removed from the X-701B Holding Pond. The East Retention Basin built in 1973, was approximately 220 ft by 65 ft (narrowing to 25 ft wide in the northeast corner) and was 3.5 ft deep. The east basin was in use from 1973 until approximately 1980. The West Retention Basin was built in 1980, when the east basin reached capacity. The west basin was approximately 220 ft by 45 ft (narrowing to 35 ft wide in the northern portion) and was 3 ft deep. The west basin was in use from 1980 until 1988.

In 1989, PORTS initiated a two-phase closure of the unit. As part of the first phase, sludge was excavated from the holding pond and two retention basins. The sludge was dewatered, placed in containers, and transported to on-site storage. The retention basins were backfilled, graded, and seeded. The second phase began in 1994, and included construction of a groundwater pump-and-treat system and in situ treatment of soils in the bottom of the holding pond with thermally enhanced vapor extraction (TEVE). Limestone riprap and gravel were placed on the bottom of the holding pond to support the soil treatment equipment. Use of TEVE was terminated after it failed to achieve identified performance standards. However, the limestone riprap and gravel material currently remains in the holding pond, and a gravel access road remains on the southeast side of the holding pond. Two pumps in a sump located in the low point of the holding pond, which have the ability to dewater the pond, remain operational. The water removed by these two pumps is transferred, via underground piping, directly into the X-623 Groundwater Treatment Facility.

During 1997 and 1998, an investigation of the X-701B Retention Basin area revealed that the saturated fill material in the retention basins was contaminated with uranium and technetium at concentrations that exceeded preliminary remediation goals (PRGs). In addition, detectable concentrations of transuranics were discovered. An evaluation of surface and subsurface radionuclide data in this area indicates there is no correlation between the sporadic detections of surface contamination and contamination found in the saturated fill material. Therefore, the higher radionuclide concentrations found in the fill material are believed to be the result of incomplete removal of sludge during initial closure actions at the retention basins. Existing data does not indicate that radioactive contaminants are migrating from the retention basins to either surface water or groundwater at concentrations exceeding PRGs.

Only groundwater samples were collected in this area during the RFI (DOE 1996). Therefore, no assessments were performed to evaluate the risk of exposure to contaminants in soils as part of the RFI. The X-701B Holding Pond and Retention Basins were integrated into the CAS/CMS process in the Director's Final Findings and Orders (DFF&Os) for Integration of RCRA Units, journalized on March 24, 1999, and included in the Quadrant II CAS/CMS Final Report (DOE 2001a), which was submitted by DOE and approved by U.S. EPA and Ohio EPA in 2001.

Figure 2

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4.2 X-701B GROUNDWATER AREA

The principal groundwater flow system for PORTS is limited to four primary geologic and hydraulic units (Minford, Gallia, Sunbury, and Berea). The uppermost unconsolidated unit is the Minford with an approximate thickness of 25 to 30 ft. The Gallia unit underlies the Minford and is relatively thick (6 to 12 ft) in the X-701B Groundwater Area. The Gallia and Minford comprise the unconsolidated aquifer at PORTS with a relatively low average hydraulic conductivity of 3.4 ft/day. Gallia groundwater flow in the X-701B Groundwater Area is assumed to be affected by the pumping of basement sumps in the X-705 building. The uppermost bedrock unit is the Sunbury Shale unit. The Berea Sandstone underlies the Sunbury Shale and is the uppermost bedrock aquifer at PORTS. The Berea is present at approximately 35 ft below land surface in this area and groundwater flow is generally to the east.

The 2001 configuration of the trichloroethene (TCE) contamination in the Gallia in the X-701B Groundwater Area is shown in Fig. 3. The X-701B Groundwater Area, extends east from the vicinity of the former X-701B Holding Pond to the vicinity of Little Beaver Creek. The plume width does not exceed 500 ft. TCE concentrations in the most contaminated portions of this plume exceed 100,000 μg/L.

The primary source of water in the hydrogeologic flow system in the X-701B Groundwater Area is natural recharge through precipitation. Leakage from storm sewers and other buried pipelines in the plant complex is not considered a significant source of recharge in the X-701B Groundwater Area. The rate of recharge varies across the site as a result of surface development (i.e., buildings, parking lots, or open fields) and also as a result of the thickness of the surficial Minford aquitard. In general, a downward vertical gradient has been observed through each of the four major hydrogeologic units underlying the site. However, because the Sunbury Shale thins along the western portion of Quadrant II, communication between the Gallia and Berea is increased. The vertical gradient between the Gallia and Berea units is greatest where the Sunbury is thick, competent shale.

Natural groundwater flow beneath the X-701B Groundwater Area is directed to the east and northeast. The flow direction is the same for both the Gallia and Berea units. Groundwater flow direction in both the Minford and the Gallia are affected by the presence of drainage ditches and holding ponds, the most predominant areas being the X-230J7 Holding Pond and the East Drainage Ditch. Vertical hydraulic gradients in this area are generally downward except to the west in the vicinity of the X-700/X-705 buildings, where vertical gradients indicate possible upward flow from the Berea to the Gallia. This is due to thinning or absence of the Sunbury Shale in this area. Groundwater recharge to the Gallia and Berea in the X-701B Groundwater Area is reduced because of the many paved areas, buildings, and the presence of thick upper Minford Clay deposits. Pumping of groundwater from sumps located in the X-705 Decontamination Building has influenced water levels over a large portion of this area and modified the direction of groundwater flow.

4.3 COMPLETED AND ONGOING INTERIM ACTIONS

4.3.1 X-701B Interim Remedial Measure (IRM) Trench

Two groundwater interceptor trenches (also known as the X-237 Groundwater Collection System) were installed in 1991 to intercept the groundwater plume emanating from X-701B before it reaches Little Beaver Creek or the East Drainage Ditch. These trenches consist of a 660-ft-long north-south primary trench with two sumps and a 440-ft-long east-west secondary trench that intersects the primary trench. The extracted groundwater is treated at the X-624 Groundwater Treatment Facility. From 1999 to 2002, the X-624 Groundwater Treatment Facility treated a total of approximately 10.7 million gal of water and

Figure 3

removed approximately 125 gal of TCE from the water (DOE 2000, DOE 2001c, DOE 2002b, DOE 2003b).

4.3.2 X-701B Extraction Well Project

Three groundwater extraction wells (X701-EW01, X701-EW02, and X701-EW03) were installed southwest of the X-701B Holding Pond as part of the ongoing RCRA closure. Extracted groundwater from the three wells along with water recovered from the sump in the bottom of the pond is processed at the X-623 Groundwater Treatment Facility. By the end of 1998, approximately 155 gal of dense non-aqueous phase liquid (DNAPL) TCE had been recovered from X701-EW01 and approximately 243 gal of DNAPL had been recovered from nearby well X701-BW2G (DOE 1999b). From 1999 to 2002, the X-623 facility has treated a total of approximately 8.7 million gal of water and removed approximately 384 gal of TCE (DOE 2000, DOE 2001c, DOE 2002b, DOE 2003b).

Due to the presence of DNAPLs, consisting primarily of TCE with some polychlorinated biphenyl (PCB) compounds, that were beyond the treatment capabilities of the X-623 facility, extraction well X701-EW01 was removed from service for several years, and the pumps in the other two extraction wells, X701-EW02 and X701-EW03, were raised to avoid extracting the same DNAPLs (see Fig. 2). In 2001 and 2002, modifications were made to the X-701B extraction wells, including installation of a DNAPL separator, returning X701-EW01 to service, and lowering pumps in wells X701-EW02 and X701-EW03 to their original levels and returning them to service.

A pre-treatment module, which consists of DNAPL separator and transfer pump, was installed in the X-701E building. Separated DNAPL is containerized in the X-701E building, and the remaining water is pumped to the X-623 Groundwater Treatment Facility for treatment.

Two pumps were planned for installation in well X701-EW01—a bottom-filling pneumatic pump near the bottom of the well and an electric pump set above the pneumatic pump. However, only the pneumatic pump is currently installed until the electrical design is revised.

4.3.3 Horizontal Wells

Following successful pilot testing of horizontal well technology at the Clean Test Site area at PORTS in 1994 and 1995, a horizontal well pilot test was conducted at X-701B Holding Pond in 1996.

Two horizontal wells were installed at the X-701B Holding Pond in May 1996 (Korte, Muck, Kearl et al. 1997). The wells, with horizontal section 71 m (234 ft) in length, were installed at a depth of 10 m (32 ft) using directional drilling methods. The wells were placed approximately 80 ft apart along the bedrock surface in a 0.9 to 2 m (3 to 7 ft) thick zone of a moderately permeable, unconsolidated fluvial deposit.

Field testing was performed for 74 days during which more than 580,000 gal of water were recirculated by extraction from one horizontal well and reinjection into the other. Pumping was performed at 23 L/min (6 gpm), but testing demonstrated that a flow rate two to three times greater could be used. No well screen or formation clogging or other hindrances to long-term performance were observed.

Hydraulic tests of well performance showed that a hydraulic gradient of 0.13 could be induced between the wells—an increase of two orders of magnitude over non-pumping conditions. A bromide tracer test demonstrated that the entire flow field was affected by the recirculation system. The tracer test also showed that preferential flow zones dominated the flow field. A low flow zone was observed in a portion of the plume where the highest technetium concentrations are present. This result was contrary to what was expected based on geologic logs from drilling, which indicated a preferential flow zone.

In 1997, a field evaluation of oxidant delivery was conducted using the horizontal wells (West 1997). A 2% solution of potassium permanganate was injected for a 30-day period at a rate of about 40 L/min (10 gpm).

4.3.4 Surfactant Solubilization

In 1996, a surfactant solubilization technology demonstration was conducted at X-701B. The principal objective of the investigation was to demonstrate that multi-component DNAPLs could be readily solubilized in the Gallia sand by dilute surfactant solutions. Surfactant solubilization (flooding) is the addition of a surface-active solution to the subsurface, which lowers the surface tension of the DNAPL, creating a very high effective solubility. A complete description of the assessment is provided in a report (INTERA 1996). The demonstration consisted of soil sampling and analysis, aquifer pumping and injection tests, numerical modeling, pre-flood partitioning interwell tracer test (PITT), solubilization (surfactant flooding) test, and post-flood partitioning interwell tracer tests.

The pre-flood PITT-1 was conducted using well X701-66G for injection and well X701-BW2G for extraction. The solubilization test duration was 5 days. Aqueous TCE concentrations did not show significant increase due to surfactant flooding. Approximately 70% of the surfactant was recovered and only about 20% of the available DNAPL was solubilized and recovered.

The surfactant flooding pilot project concluded that additional pilot testing would be required to demonstrate effective solubilization of DNAPL. Operational procedures could be improved such as methods to assure complete mixing of injectant.

4.3.5 Hydrous Pyrolysis/Oxidation

Steam stripping and hydrous pyrolysis/oxidation is an emerging remediation technique in which steam is delivered to the subsurface to mobilize or vaporize contaminants. Steam is injected through wells. The mobilized contaminants are removed through extraction wells and the volatilized contaminants are removed via vacuum extraction. During the steam stripping process, hydrous pyrolysis/oxidation destroys DNAPLs and dissolved contaminants in place by utilizing hydrothermal oxidation. The injected steam creates a heated oxygenated zone that oxidizes and degrades the contaminants to benign products like carbon dioxide, water, and chloride ions.

A hydrous pyrolysis/oxidation pilot project was conducted in 1999 at the western end of the X-701B Groundwater Area plume. Results of the pilot project showed that over 800 lbs of TCE were recovered (Steam Tech 1999).

4.3.6 Other Tests

Following a field demonstration of pneumatic soil fracturing at the Clean Test Site area in 1994, a pilot study was initiated in the X-701B Groundwater Area during the summer of 2000. This pilot study was initiated to evaluate the use of pneumatic soil fracturing in conjunction with oxidant injection and was planned to use 144 injection locations over a grid of 180 ft by 80 ft. However, due to an accident, the project was terminated prior to completion, and further data was never collected to complete the project.

An extensive technology demonstration project using soil mixing with vapor extraction, oxidation, or solidification was conducted at the X-231B Southwest Oil Biodegradation Plot (ORNL 1993). Following completion of the X-231B field test, a limited test was conducted at the X-701B Holding Pond; however, no documentation describing the test activities at X-701B is available. The soil mixing test used the same equipment that was used in the X-231B test. Without documentation, no information regarding the test can be verified. The test was ended prematurely due to either health and safety issues or contractual issues.

5. SCOPE AND ROLE OF THE RESPONSE ACTION

VOCs, including TCE and TCE degradation products, and low levels of uranium and technetium have been identified as the primary contributors of risk associated with soils at the X-701B Holding Pond and Retention Basins (soils only). The objective of the remedial action to be implemented at this area is to prevent exposure of on-site workers to contaminants of concern (COCs) in soils and to prevent or limit contaminants from leaching into groundwater.

VOCs (TCE and TCE degradation products) in groundwater have been identified as the primary contributors to risks associated with the X-701B Groundwater Area plume. The objectives of the remedial action to be implemented at this groundwater area SWMU are to prevent exposure of on-site workers to COCs in groundwater, to prevent COCs in groundwater from migrating and discharging into surface water streams, and to restore the groundwater quality to PRGs to the extent practicable.

6. DESCRIPTION OF THE SELECTED REMEDIES

The Ohio EPA's preferred remedial alternatives for X-701B are as follows.

6.1 X-701B HOLDING POND AND RETENTION BASINS (SOILS ONLY)

The preferred alternative for X-701B Holding Pond and Retention Basins is select solids excavation and consolidation in conjunction with capping and is a modified version of Alternative 3 in the Quadrant II CAS/CMS (Fig. 4).

This modified version of Alternative 3 consists of implementing deed and land use restrictions, selective removal of outlying soil, and consolidation under two caps. The caps shall be engineered to meet the RCRA Subtitle C substantive requirements as noted in Ohio Administrative Code (OAC) 3745-56-28. One cap would cover the X-701B Holding Pond and the East Retention Basin. The second cap would cover the West Retention Basin. Selected contaminated soils beyond the footprint of the caps would be consolidated to fit under one or both caps. Prior to placement of the consolidated soil, the bottom of the holding pond will be filled with 8 ft of clean fill and a 2-ft recompacted clay barrier will be installed, overlain by a flexible membrane liner. The purpose of the barrier layer and liner is to significantly reduce infiltration of contaminants into groundwater.

Completion of all remedial activities associated with this unit will meet the substantive requirements of RCRA as noted in the Ohio EPA's DFF&Os for integration of RCRA units, Section VI, Paragraph 2. All surface water drainage shall be directed around the caps. Culverts, or drainage ditches or process lines shall not be placed under the cap in areas where waste has been placed. Control measures such as silt fences, erosion control, and dust prevention will be implemented to ensure that environmental receptors and habitats surrounding PORTS are not affected by construction activities. All activities required to treat the groundwater and DNAPL beneath the holding pond area and retention basins would be completed prior to installation of the cap.

Institutional controls will effectively prevent exposure of on-site workers during the time this alternative is in operation. Deed and land-use restrictions will limit future land use, place limitations on excavation depths, and prohibit development of groundwater for use as a potable water supply. The groundwater-monitoring program will use existing monitoring wells to monitor contaminant fate and transport. Groundwater will be monitored at least semiannually or as needed during the start of the remedial process, and the monitoring results will be reported in the Annual Groundwater Monitoring Report. The Integrated Groundwater Monitoring Plan (IGWMP) will include sampling parameters and frequency, which may change as remediation progresses.

This remedy is considered protective of human health and the environment both in the short term and over the long term. This alternative will meet ARARs, be cost-effective, and provide long-term effectiveness.

6.2 X-701B GROUNDWATER AREA

The selected alternative for the X-701B Groundwater Area is oxidant injection, groundwater recirculation, and phytoremediation, if necessary, and is a modified version of Alternative 8 in the attachment (DOE 2002a) to the Quadrant II CAS/CMS. This alternative includes the following:

- Oxidant injection and groundwater recirculation in the identified portion of the plume;
- Limited oxidant injection into the eastern horizontal well;
- Additional phytoremediation, if necessary, in the eastern portion of the plume between the interceptor trench and Little Beaver Creek to enhance existing phytoremediation that is ongoing; and
- Deed and land-use restrictions to limit future land use, place limitations on excavation depths, and prohibit development of groundwater for use as a potable water supply.

The oxidant injection area will focus on the location where the source area is believed to be located. This area is bounded by the security fence in the east and approximately Brown Avenue to the west (Fig. 5). The oxidant injection shall be performed for the entire thickness of the Gallia, and potentially into the upper Sunbury. Where necessary, oxidant injection may include areas within the Minford in the southwest area of the X-701B Holding Pond. The frequency and number of oxidant applications shall be dependent on the residual COCs in the Minford, Gallia, and Sunbury formations. The specific injection locations, number of injection points, and the preferred oxidant(s) will be evaluated and determined during the design. Should the sampling results of wells within the source area and the plume indicate the oxidant injection is no longer effective, modifications to the design may be necessary. The criteria for determining when oxidant injection is no longer effective shall be developed in the remedial design. It is expected that the remedy will be operated a minimum of five years, until remedial action objectives (RAOs) are attained or sooner if Ohio EPA determines that the selected remedial technology is no longer effective in removing contaminant mass.

Figure 4

back of Figure 4

Figure 5

Sampling will be performed periodically to determine if the injection of oxidant has been effective and continues to be effective. Current pumping wells will be incorporated into the design as needed, and the IRM trench is expected to continue operation until RAOs are met.

The eastern horizontal well will also be used to inject a limited quantity of oxidant into the plume. The purpose of injecting into this horizontal well is to remediate the portion of the plume that extends eastward from this well (near the security fence) to the interceptor trench. The interceptor trench would be operated and maintained until RAOs are met throughout the plume.

Additional phytoremediation will be implemented throughout the area between the interceptor trench and Little Beaver Creek, if necessary, to enhance the phytoremediation that is ongoing. The phytoremediation area would cover approximately 2.1 acres and would include planting trees, if needed, while DOE is actively remediating groundwater. Phytoremediation would remediate any TCE in groundwater that exists beyond the trench and protect Little Beaver Creek from contamination.

Deed and land-use restrictions will prevent residential development, place limitations on excavation depths, and prohibit development of groundwater for use as a potable water supply. Groundwater monitoring would be initiated to assess the effectiveness of this alternative. The groundwater monitoring program would use existing monitoring wells to monitor contaminant fate and transport.

Under this alternative, contaminant mobility and total volume would be reduced through in situ destruction of the contaminant. The X-701B Groundwater Area will be re-evaluated 5 years after implementation of the selected alternative.

Groundwater will continue to be monitored throughout the remediation process. Additional groundwater wells may be installed to monitor remediation progress, if needed, and will be incorporated into the IGWMP. The IGWMP will include sampling parameters and frequencies. The parameters and frequencies of monitoring may change as remediation progresses. Groundwater will be monitored at least semiannually or as needed during the start of the remedial process, and the monitoring results will be reported in the Annual Groundwater Monitoring Report.

This alternative will be protective of human health and the environment in the short and long terms. This alternative also will meet ARARs, be cost-effective, and provide long-term effectiveness.

7. CMI TASKS

As required in the ACO, the CMI Program consists of four tasks:

- CMI Program Plan (Task 12);
- Corrective Measure Design (Task 13);
- Corrective Measure Construction (Task 14); and
- Reporting (Task 15).

The generic PORTS CMI Program Plan provides a general framework for controlling and implementing corrective action alternatives at PORTS. This generic plan consists of the distinct sections of Tasks 12 through 15 that apply to CMI activities anywhere on the PORTS site. The distinct sections are: The Program Management Plan, the Program Community Relations Plan, the Construction Quality Assurance Program Plan, the Safety and Health Accident Prevention Plan, and the Generic Schedule.

This X-701B CMI Program Plan (Task 12) includes specific activities outlined in the X-701B Decision Document that are not detailed in the generic PORTS CMI Program Plan. The X-701B specific requirements for each task are described below. The schedule for accomplishing activities associated with Tasks 13 through 15 is included in Appendix A of this plan.

7.1 CMI PROGRAM PLAN (TASK 12)

The ACO requires the CMI Program Plan to include a Program Management Plan, a Program Community Relations Plan, and a generic schedule.

7.1.1 Program Management

Program management for the X-701B CMI will be performed as directed by the Program Management Plan included in the generic PORTS CMI Program Plan and as described below.

DOE, as owner of the PORTS site, ensures that the site activities are conducted in accordance with RCRA and other applicable environmental requirements and is in compliance with the ACO. Inherent with this role is the responsibility to comply with and to accomplish the objectives set forth in the regulatory requirements. DOE will retain contractors to conduct or monitor any or all portions of the work related to the X-701B CMI.

Bechtel Jacobs Company LLC (BJC) manages and operates the PORTS Environmental Management Program in compliance with federal, state, and local requirements and provides deliverables to DOE that meet the intent of the requirements for remediation and cleanup. BJC also provides oversight of all activities performed during the X-701B CMI with regard to health, safety, environmental compliance, quality assurance, and compliance with security standards. This oversight role ensures that these elements of the X-701B remediation work are properly integrated into the CMI.

The U.S. EPA and Ohio EPA are integral members of the X-701B CMI Program team. These agencies have access to the PORTS facility to oversee activities performed under the ACO, including interviewing PORTS personnel, inspecting documents related to work performed under the ACO, reviewing progress in carrying out the terms of the ACO, conducting sampling and tests, and verifying X-701B CMI Program documents submitted by DOE.

7.1.2 Community Relations

The U.S. EPA and Ohio EPA presented the X-701B Preferred Plan to the public in a meeting held October 7, 2003. During the meeting and the 45-day comment period, the agencies received no significant public comments and no opposition to the Preferred Plan.

Community relation activities will be conducted according to the Program Community Relations Plan. This X-701B CMI Program Plan includes an updated Program Community Relations Plan as Appendix B. Publication and distribution of a fact sheet describing the X-701B corrective action will commence when construction activities begin and will be updated as needed. Progress of the X-701B corrective action will also be discussed in public meetings held for the PORTS site.

7.1.3 Corrective Measures Schedule

The schedule for accomplishing activities associated with Tasks 13 through 15 is included in Appendix A of this plan.

7.2 CORRECTIVE MEASURE DESIGN (TASK 13)

The Corrective Measure Design provides detailed information necessary for the design, construction, operation, and maintenance of the corrective measures. A cost estimate and a detailed schedule will be prepared, and construction quality assurance objectives will be determined. The ARARs will be considered in the remediation design. The design will be developed in two phases, preliminary (50%) and pre-final (95%).

During preliminary design, the volume of wastes from the selected CMI remedy will be estimated. DOE will evaluate all waste generated to ensure that disposal is compliant with ARARs and the substantive requirements of RCRA. Groundwater collected during well development will be taken to an approved on-site treatment facility. Sanitary waste generated during construction will be disposed off-site. The BJC Waste Management Division will ensure that the design specifications cover all requirements for managing, transporting, storing, and disposing of each type of waste.

7.3 CORRECTIVE MEASURE CONSTRUCTION (TASK 14)

The Construction Quality Assurance Program Plan (included in the agency-approved generic PORTS CMI Program Plan) contains a general description of construction management responsibility and authority, construction quality assurance personnel qualifications, inspection activities, sampling requirements, and documentation requirements. SWMU-specific plans will be developed by the construction subcontractor and will conform to the corresponding PORTS generic plans. Additional requirements specific to the X-701B remediation project will be addressed in the Subcontractor Construction Quality Assurance Plan and Safety and Health Accident Prevention Plan.

Notification will be made to Ohio EPA upon start of construction.

7.4 REPORTING (TASK 15)

The X-701B CMI reporting task includes monthly technical progress reports to be submitted to Ohio EPA and Quarterly Progress Reports to U.S. EPA throughout the CMI program. DOE will also submit monthly technical progress reports during the design and construction phases of the remedial action.

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APPENDIX A

X-701B CORRECTIVE MEASURES IMPLEMENTATION PLAN SCHEDULE

APPENDIX B

UPDATED
PROGRAM COMMUNITY RELATIONS PLAN

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